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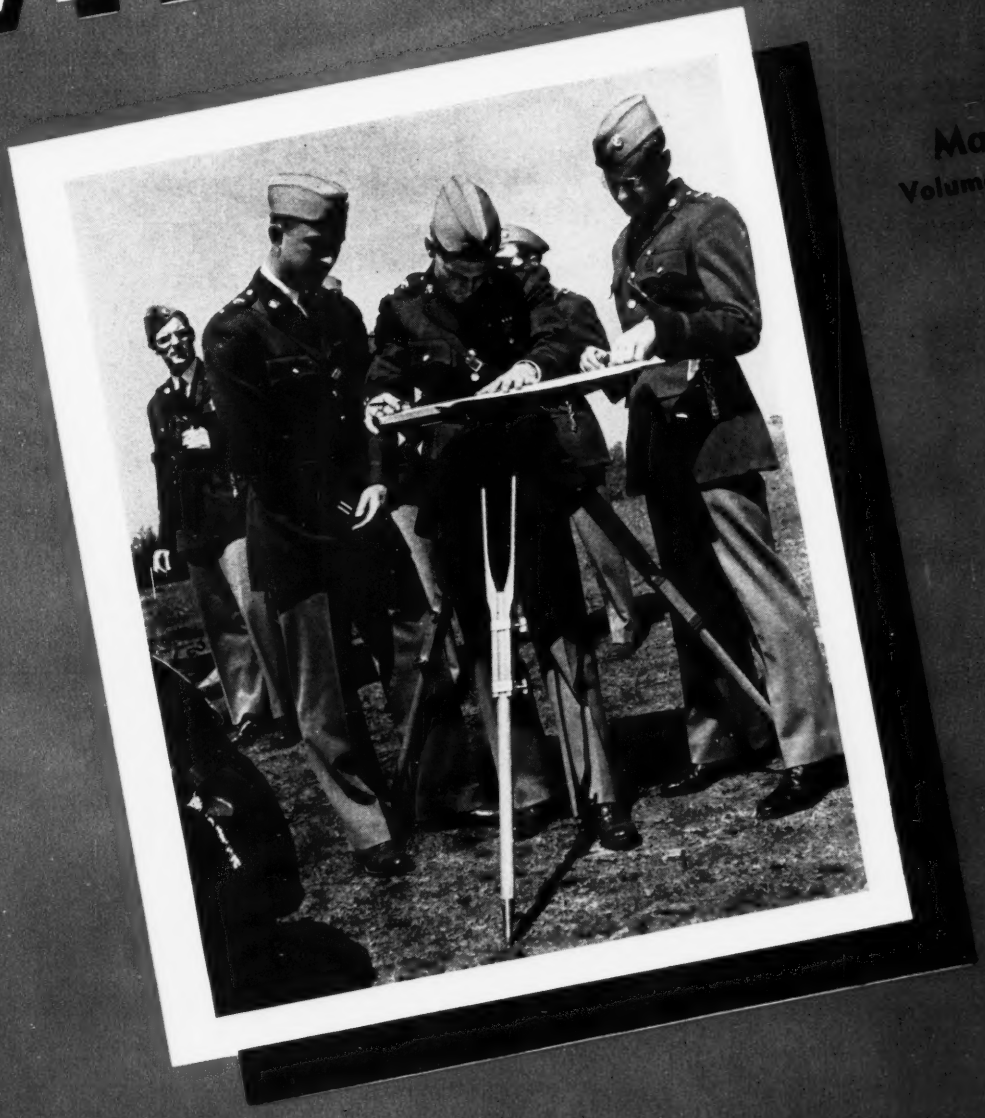
MAR 27 1942

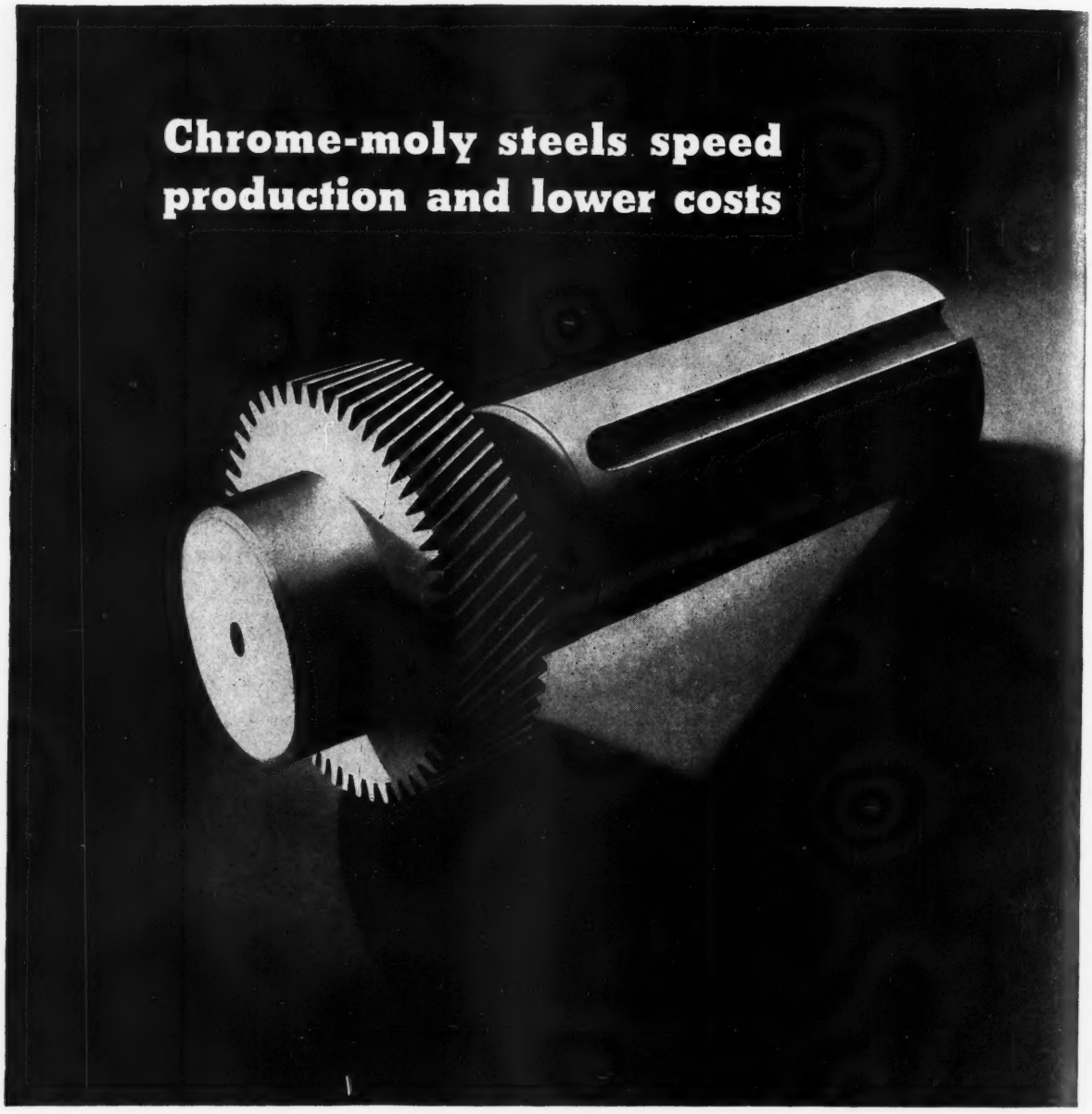
THE CORNELL ENGINEER



March, 1942
Volume 7—Number 6

COLLEGE OF ENGINEERING · CORNELL UNIVERSITY

Chrome-moly steels speed production and lower costs



A manufacturer of speed reduction gear pinions is taking advantage of two of the outstanding advantages of Chromium-Molybdenum (4140) steel — uniform hardening in heavy section, and excellent machinability at intermediate hardnesses.

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Ad No. 127—College

The heat treatment that contradicted itself

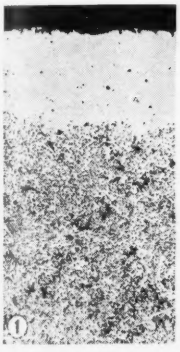
How Westinghouse Engineers straightened out a paradox in steel

METALLURGISTS have been heat-treating steel for 2,500 years. They've taken steel parts, subjected them to heat, cooled them quickly by quenching them in water, oil, or gas, and so hardened them.

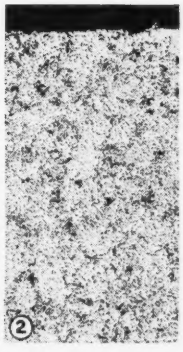
But the heat treatment contradicted itself.

For while they were heat-treating the steel to harden it . . . they also softened it. As the steel was being heat-treated, oxygen combined with the surface carbon, decarburized and softened the surface.

Naturally, metallurgists had to remove this softened surface. They had to pickle, grind, or machine the surface—processes



This photomicrograph of SAE-6150 Spring Steel shows .005" decarburization with ordinary scale-free atmosphere.



This photomicrograph of SAE-6150 Spring Steel shows no decarburization with Endogas atmosphere.

which not only wasted time and cost money but also accounted for a whole lot of inefficiency.

The dimensions of many steel parts, especially dies, have to be accurate to a few thousandths of an inch. So, metallurgists had to make the steel parts larger to start with, just enough larger so that they'd be the right size after the softened surface had been removed. And that left room for plenty of mistakes.

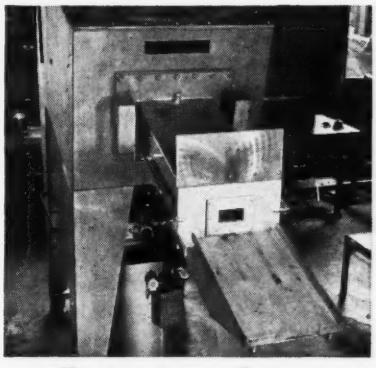
▸ Something, Westinghouse engineers decided, should be done to get rid of all this heat-treating trouble.

They figured the thing to do was to find a way to keep carbon-hungry oxygen from getting at the steel surface. And that was the thing they did.

First, they settled on using an electric furnace since it would give them accurate temperature control and entirely eliminate gas fumes. Then, they created a special atmosphere for the furnace. They heated ammonia (NH_3) in the presence of a catalyst and separated it into its component parts, nitrogen and hydrogen. The nitrogen is inert and won't combine with anything. The hydrogen, in the absence of oxygen and water vapor, also refuses to have anything to do with the carbon.

In this special atmosphere, which Westinghouse engineers called Ammogas, steel parts could be treated with electric heat and . . . no softening of the outer surface took place, no time-wasting, inefficient finishing had to be done. The dies and other steel parts came out of their heat treatment bright, shiny, all ready to use.

▸ The Ammogas furnace that Westinghouse engineers created took care of the heat-treating of costly parts like dies, which can be gas-hardened and are not produced in great quantities. But Ammogas is expensive—too expensive for



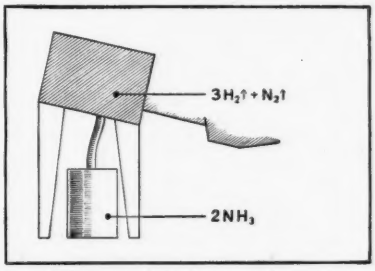
Here is an Ammogas Furnace.

the ordinary heat-treating of thousands of machine parts. And it is not suitable for heat-treatments requiring high temperatures.

So Westinghouse engineers developed Endogas—a special atmosphere which would do large-quantity, high-temperature heat-treating jobs, and do them at low cost. They heated ordinary gas (natural or manufactured city gas is all right) and, by a special but inexpensive process, changed it into a gas rich in hydrogen and carbon monoxide and containing a little water vapor and carbon dioxide.

Endogas doesn't do its work by *avoiding* all decarburizing agents, carbon dioxide and water vapor; it *overpowers* them by the inclusion of agents like carbon monoxide and methane that work in the opposite direction.

In effect, Endogas maintains a balance between carburizing and decarburizing forces. This balance can be so closely controlled that it is even possible to *add*



A diagram of the Ammogas furnace.

carbon to the steel that's being heat-treated.

Today, the Ammogas and Endogas furnaces are hard at work heat-treating dies, castings, airplane parts, steel parts of all kinds, helping to turn them out faster and better—saving industry time, money, and mistakes—speeding crucial war production.

★ ★ ★

There is one reason why Westinghouse was able to create controlled atmosphere furnaces and lick decarburization. It is because Westinghouse is an engineer's company.

There are 3,500 engineers in Westinghouse . . . in service, in sales, in design, in research, in management, in every branch of the business. Engineers hold key positions in each of the 17 Divisions of the Westinghouse Company.

Engineers determine our ability to find better ways to get jobs done. Engineers direct the creation and manufacture of our products. Upon engineers our success depends.

Behind our training and our encouragement of individual effort, there is a definite purpose. Behind our organization set-up of many divisions, which are like small companies within a company, there is a definite purpose. That purpose is to develop young engineers like you into the kind of engineers who will take good care of our future.

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"An Engineer's Company," Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.

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Return of the Carbon Age

CARBON . . . one of Nature's oldest and most plentiful materials . . . is making possible some of industry's newest achievements.

In the *chemical* industry, massive black towers of carbon . . . erected in incredibly short periods of time . . . speed the delivery of vital acids. The all-carbon electrostatic precipitator... built of carbon from the bottom to the top of the stack . . . is now an actuality. Such towers can be erected in as little as a *week's time!* Staunchly immune to corrosion and thermal shock, they should last *indefinitely.*

Today . . . due to basic and applied research into the properties of carbon and graphite . . . it is possible to obtain these black, wonder-working materials in such a variety of forms—blocks, bricks, beams, tubes, pipes, and fittings . . . even valves and pumps . . . that almost any size or shape of structure can be built from them. For making tight joints, which give the structure uniform properties throughout, special carbon- and graphite-base cements have been developed.

Undisturbed by the torture of heat, carbon is also a "must" in the *metallurgical* industry. Carbon *cannot be melted* . . . will not soften . . . and has remarkable dimensional stability even at incandescent heat. In addition, it will not flake off and hot metal will not stick to it. That is why it is ideal for such uses as molds, cores, and plugs . . . for the lining of furnaces . . . and for sampling-dippers.

Because electric-furnace graphite conducts heat even *better than most metals,* it is becoming increasingly important in the manufacture of heat exchangers for the processing of corrosive liquids and gases.

These new uses for carbon and graphite... added to the almost interminable list of uses that existed before . . . make this era truly a carbon age. Your inquiries are cordially invited.

The strides made in the development of structural carbon, and in the uses of other carbon and graphite products, are greatly facilitated by the technical assistance of other Units of Union Carbide and Carbon Corporation including The Linde Air Products Company, Carbide and Carbon Chemicals Corporation, Electro Metallurgical Company, Haynes Stellite Company, and Union Carbide and Carbon Research Laboratories, Inc.— all of which collaborate with National Carbon Company in research into the properties and applications of carbon and graphite.

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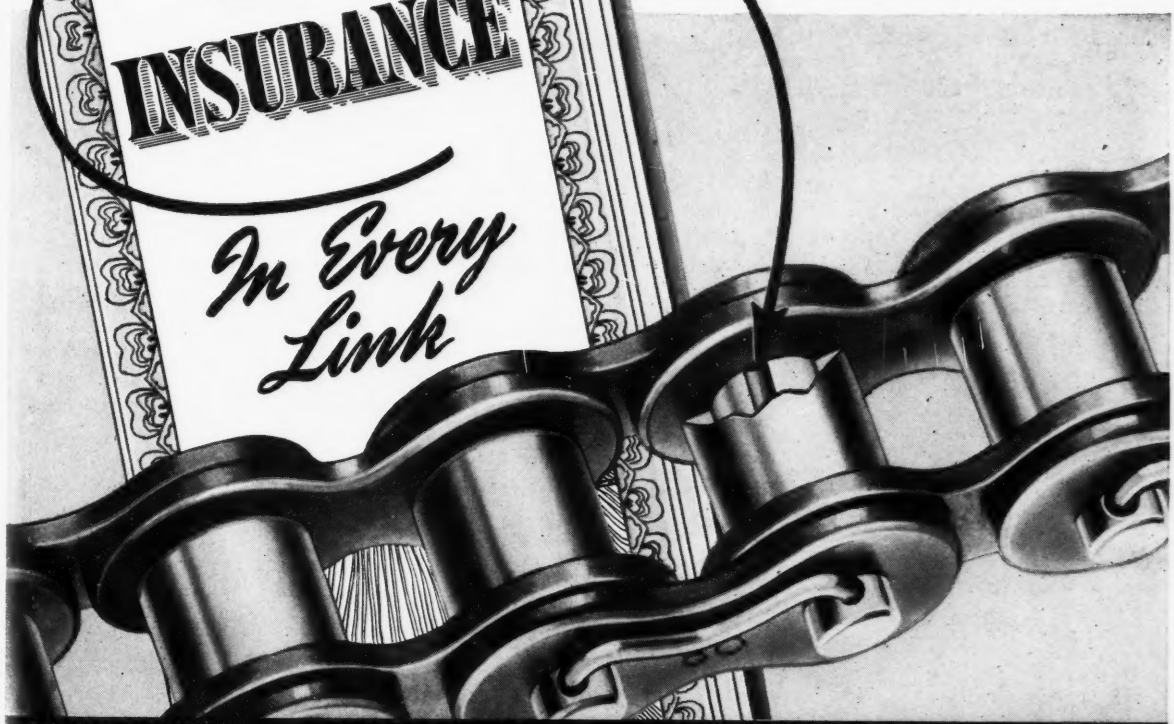

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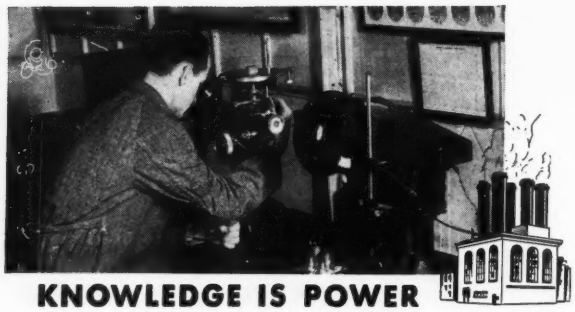

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The CORNELL ENGINEER

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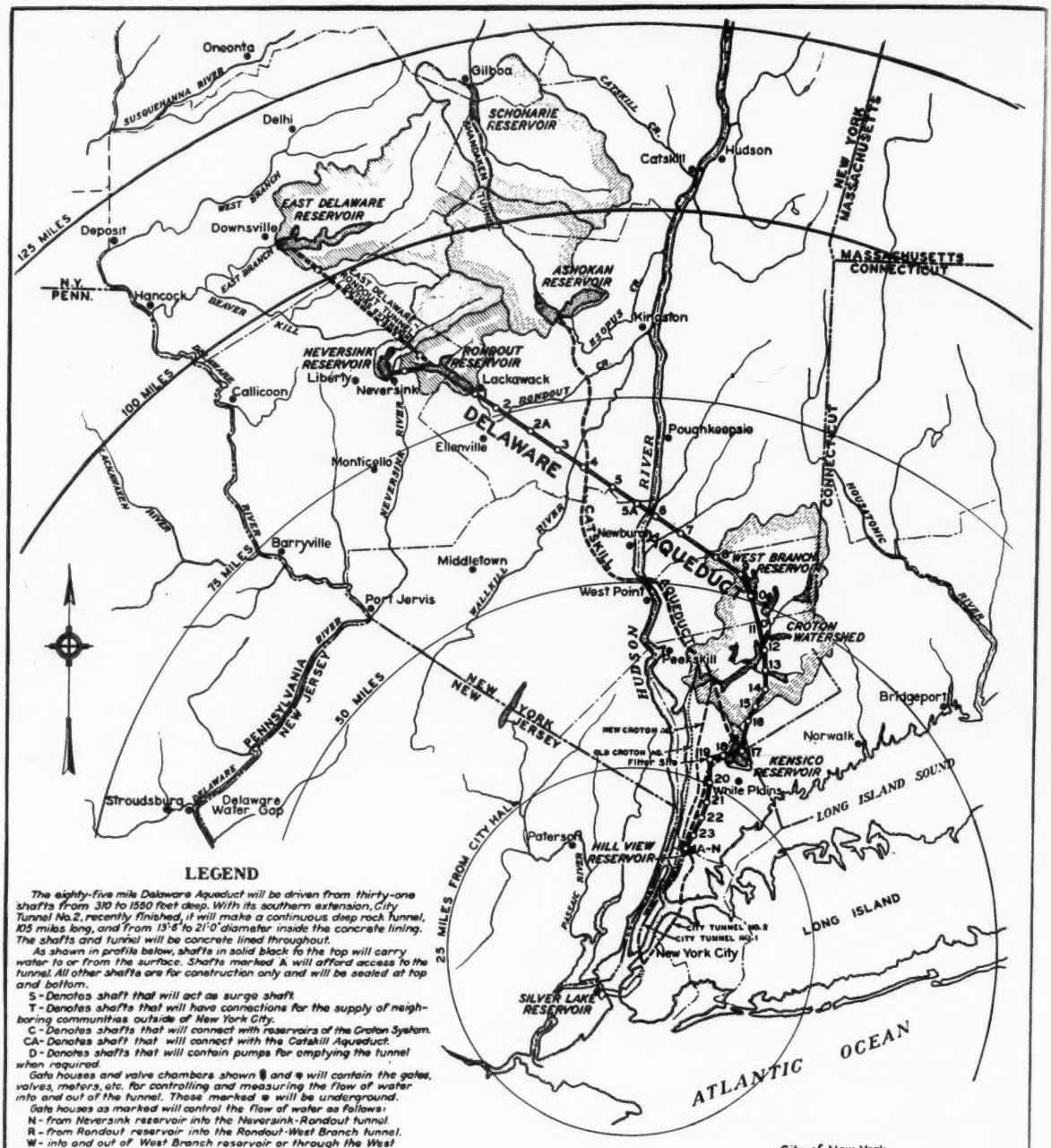


LEGEND

The eighty-five mile Delaware Aqueduct will be driven from thirty-one shafts from 310 to 1560 feet deep. With its southern extension, City Tunnel No. 2, recently finished, it will make a continuous deep rock tunnel, 105 miles long, and from 13'-6" to 21'-0" diameter inside the concrete lining. The shafts and tunnel will be concrete lined throughout.

As shown in profile below, shafts in solid black to the top will carry water to or from the surface. Shafts marked A will afford access to the tunnel. All other shafts are for construction only and will be sealed at top and bottom.

S - Denotes shaft that will act as surge shaft.

T - Denotes shafts that will have connections for the supply of neighboring communities outside of New York City.

C - Denotes shafts that will connect with reservoirs of the Croton System.

CA - Denotes shaft that will connect with the Catskill Aqueduct.

D - Denotes shafts that will contain pumps for emptying the tunnel when required.

Gate houses and valve chambers shown ① and ② will contain the gates, valves, meters, etc. for controlling and measuring the flow of water into and out of the tunnel. Those marked ② will be underground.

Gate houses as marked will control the flow of water as follows:

N - from Neversink reservoir into the Neversink-Rondout tunnel.

R - from Rondout reservoir into the Rondout-West Branch tunnel.

W - into and out of West Branch reservoir or through the West Branch By-pass tunnel.

K - into and out of Kensico reservoir or through the Kensico By-pass tunnel.

F - to and from the Eastview filters when these are built on the site already owned by The City.

H - into and out of Hill View reservoir or through the Hill View By-pass tunnel.

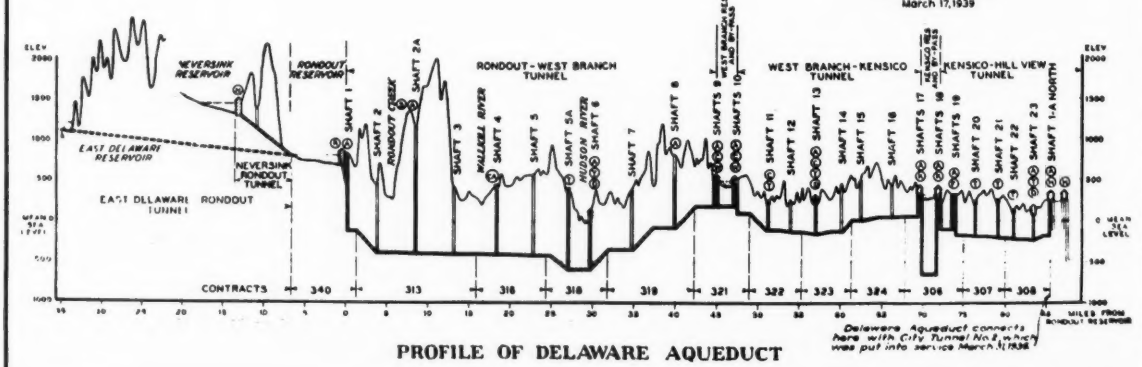
City of New York

BOARD OF WATER SUPPLY

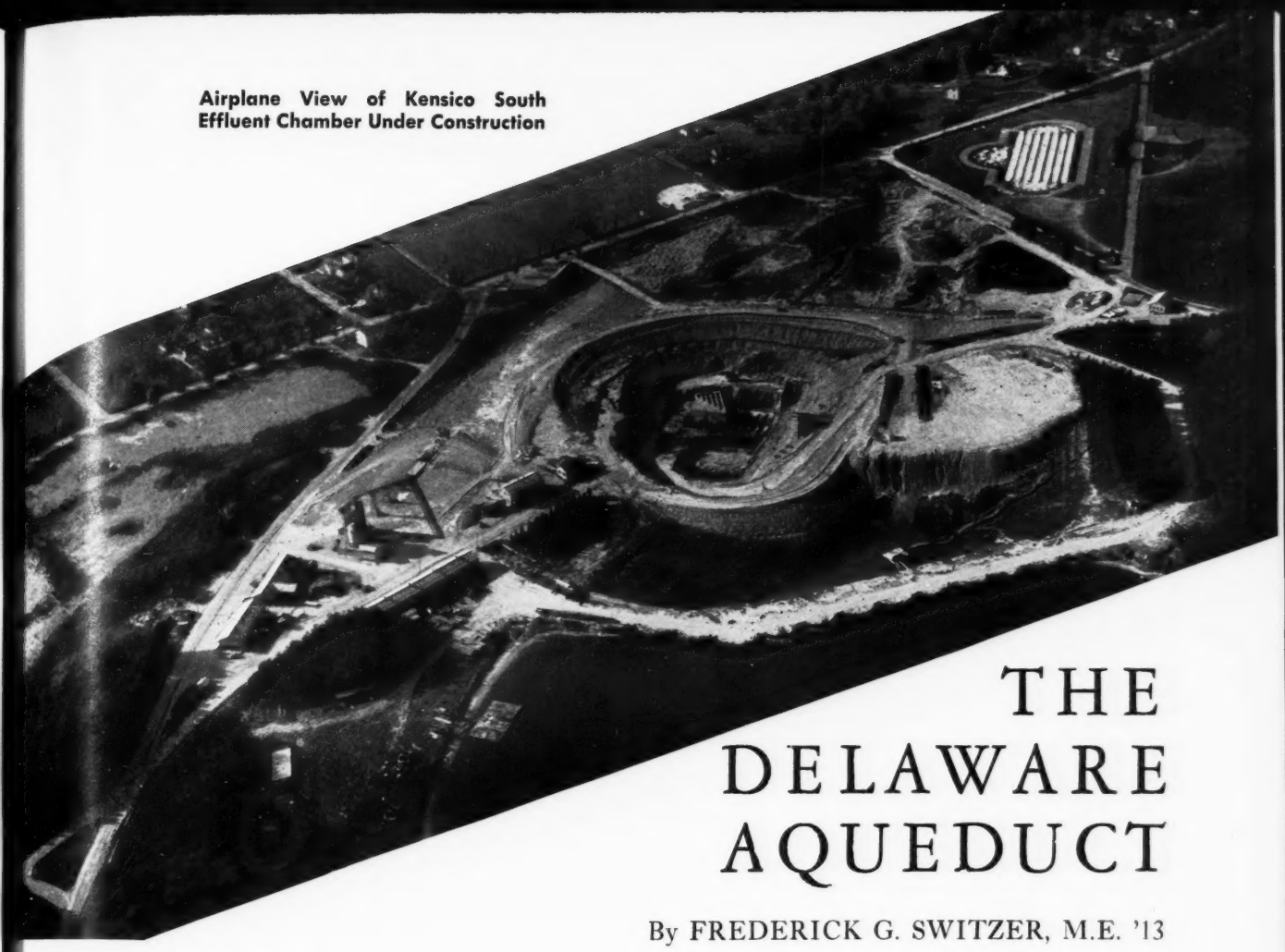
DELAWARE AQUEDUCT

PLAN AND PROFILE

March 17, 1939



PROFILE OF DELAWARE AQUEDUCT



Airplane View of Kensico South Effluent Chamber Under Construction

THE DELAWARE AQUEDUCT

By FREDERICK G. SWITZER, M.E. '13

LIKE most other places, New York City continues to grow, and the water supply must be augmented from time to time to keep up with the city. The old Croton System and the newer Catskill System are meeting demands which at times approach or exceed their dependable limits. Recognizing this condition, the city authorities, as far back as 1921, authorized studies to determine what should be done to provide additional water supplies. Six years later a report was presented which concluded that the best and most economical source of supply could be had from tributaries of the Delaware River within the State of New York. Inasmuch as the Delaware River is an interstate stream, the States of New Jersey and Pennsylvania were involved. Interstate compacts were agreed upon between representatives of the three states, but only the State of New York ratified. However, the plans were approved by the necessary New York State and City authorities. The State of New Jersey then started court action to prevent diversion of Delaware River water, and the State of Pennsylvania was an interested party. A Special Master was appointed by the United States Supreme Court to collect evidence on the matters in dispute and make recommendations. In 1931 this report was ready, and was approved by the Court. The decree finally entered limited the diversion from the Delaware River to 440 million gallons per day and gave New York City the right to petition for additional diversion at a future date. It is this quantity of water which the City is now preparing to deliver, together with some 100 million gallons per day from Rondout Creek, a tributary of the Hudson River wholly within the State. While the necessary authority was received in 1931, it was not until 1936 that appropriations were made for the start of construction. The intervening years, years of depression, saw a reduction in the demand for water, and a postponement of construction was possible.

The plan of construction contemplates three stages as follows:—The first stage involves the construction of reservoirs on Rondout Creek and Neversink River (the latter a tributary of the Delaware River) together with a tunnel connecting these reservoirs to the main distributing reservoir just north of the city. This stage makes available a new supply of 170 million gallons per day. The second stage involves the construction of a reservoir on the East Branch of the Delaware River and a tunnel connecting this reservoir to the Rond-

out reservoir of the first stage. The second stage makes available an additional supply of 370 million gallons per day, the limit allowed by the court decree. The third stage involves the collection of water from more distant tributaries of the Delaware when the need arises and when authority is granted for the additional diversion.

At the present time, only the first stage is under construction. A reservoir on the Rondout Creek, with a dam at Lackawack, is well along. A second reservoir, with a dam, on the Neversink River near the village of Neversink is in the preliminary stages. A tunnel 85 miles long, from the Rondout reservoir to Hill View reservoir, is nearing completion. The locations of these constructions together with the older Croton and Catskill Systems are shown on the frontispiece. The total cost of completing the first stage of this development will be in the neighborhood of $236,000,000. The first contracts for construction were awarded on January 22, 1937, and on March 24, 1937, Mayor F. H. LaGuardia fired the first shot with appropriate ceremonies. Since then additional contracts have been awarded and rapid progress has been made, although delays due to present conditions have slowed up the work to some extent.

The tunnel is built in three sections. The first 45 miles of tunnel are of 13 feet 6 inches inside diameter and connect the Rondout reservoir with the West Branch reservoir of the Croton System. Here there is an interconnection whch permits the diversion of Croton water into the Delaware Aqueduct. The works for controlling the flow in this section are at the northernly end. Six large conical plug valves permit close regulation. The head difference between the Rondout reservoir and the West Branch reservoir will average about 335 feet but may vary between wide limits as one or both of the reservoirs are drawn down in dry weather. Under low head and high flow rate conditions, the head available will be used up in control works and tunnel friction. Hence no dependable power is available, and no attempt has been deemed warranted to make power available even part of the time. Every precaution has been taken to provide energy dissipation under high head and low flow rate conditions without injury to the adqeuduct. Space here does not permit discussion of this interesting phase of the work. Suffice it to say that model studies were made of several schemes. These gave information for intelligent design. There remains at this time only a short distance of tunnel excavation in this section. The tunnel is to be concrete lined throughout its length. A heavy infiltration of water made it necessary to adopt special methods of construction, including the grouting of the surrounding volumes and the driving of a small pilot tunnel to permit more thorough grouting before the full-size tunnel could be excavated.

The water arriving at the West Branch reservoir may be passed into the reservoir or by-passed by a tunnel to the effluent chamber which discharges into the next section of the tunnel. The effluent chamber takes water from the reservoir or from the by-pass tunnel as may be found desirable. Normal operation is expected to be into and out of the West Branch reservoir. The time for passage through the reservoir gives an opportunity for the deposit of any silt which may be carried by the water and for the reduction of bacteriological content. However, if the need arises, the reservoir can be separated from the Delaware System and the two sources used independently.

The second section of tunnel connects the West Branch reservoir with the Kensico reservoir—a distance of 27 miles. The tunnel is 15 feet in diameter in this section, large enough to carry the Delaware supply and some of the Croton supply as well. The arrangements at Kensico are of the same kind as at West Branch. Water may be passed through the Kensico reservoir or by-passed through a deep tunnel. The control point for flow in this section is at the upper, or West Branch end.

The last section of the tunnel is over 13 miles long and 19 feet 6 inches in diameter and connects the Kensico reservoir to the Hill View reservoir, just north of the City limits. The latter is the main point of distribution from which water is delivered to two tunnels which carry the water to the various sections of the City. The Hill View reservoir is relatively small and serves only to take care of hour-to-hour variations in demand. At Kensico the water may receive treatment in a coagulating plant for precipitation of any turbidity there remaining. The reservoir is used for holding the clear water. There is also an aerator at this point—a spray pond in which the water is saturated with air before leaving Kensico. Provision is made for the future construction of a filter plant if it is found necessary.

Because of the small size of the Hill View reservoir, the main point

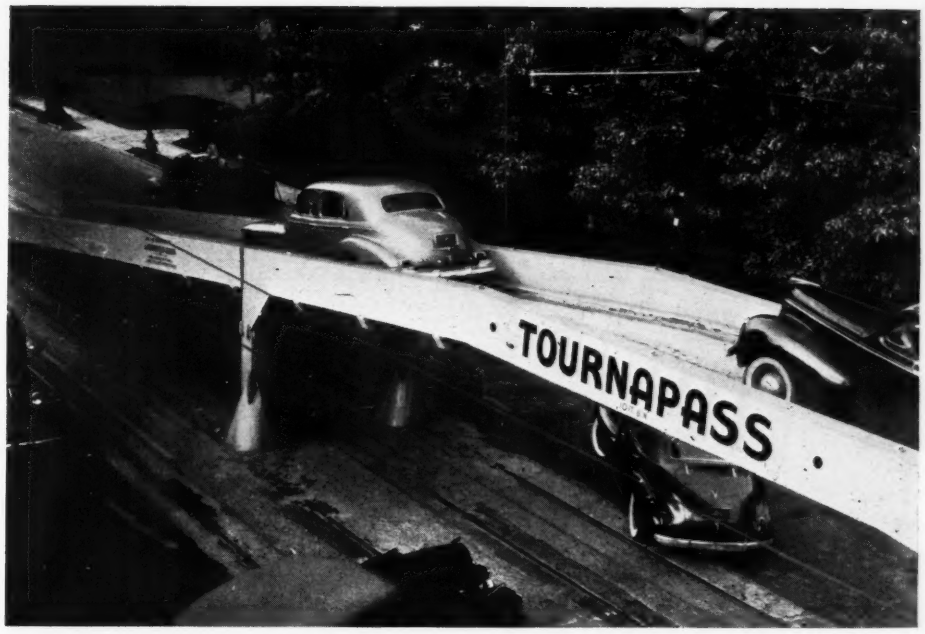
(*Continued on page 20*)

THE AUTHOR

UPON graduating with an M.E. degree in 1913, F. G. Switzer worked as a test engineer for General Electric and later as design engineer for Crocker-Wheeler Co. In the meantime he received his M.M.E. from Cornell and came to the University in 1916 as an instructor, rising to professor and head of the department of mechanics of engineering.

In 1940 he left Cornell to become division engineer in charge of mechanical and electrical equipment design for the New York City Board of Water Supply on the Delaware Aqueduct.

The future: Left turns without stopping.



Cut Courtesy Highway Magazine

A SOLUTION TO TRAFFIC CONGESTION

By LOUIS L. WILLIAMS, III, EE '45

LATE last summer as I was driving home from downtown Atlanta, I noticed four or five men putting up two steel piers at the intersection of Peachtree and Wesley Roads, a very busy corner during the rush hours. Upon investigation I found that the men were erecting a "Tournapass"—a portable automobile overpass still in its experimental stage, built by Le Tourneau Company of Georgia.

The roadbed of the overpass is in three 60-foot sections and is supported by four steel posts which fit into adjustable steel piers; these are necessary to allow for variations in the street elevations and for various clearances under the center span.

The overpass is of the all-welded box-beam type of construction, and the roadbed is wide enough to provide a two-foot clearance on either side when an ordinary automobile is centered on the span. Despite this much clearance, there were a few drivers who nicked their fenders coming on to the overpass, and therefore the overpass is to be made wider and will have a newly designed guard before being put on the open market. This guard will eliminate the possibility of any part of the car except the tires contacting the overpass .

The ramps which lead to and from the center span have a 12 per cent grade. It was found that the best speeds at which to cross on the overpass were from 15 to 22 miles per hour. Changes in the roadway design of the newer overpass are expected to permit safe driving at speeds up to 25 or more miles per hour. During this experimental run it was noted on wet days that the roadbed became slick, so a "non-skid" surfacing will be employed; in fact, two types of flooring will be available on the new overpass—both "non-skid." Even without this surfacing, however, a car is safer on the overpass than at an ordinary intersection because there are no pedestrians to cause sudden stops. Running off the track is impossible because the side walls are too high. Since the auto has little room in which to turn, the resultant force in the event of a collision with the side wall would be directed along the length of the structure.

This overpass was in operation for three weeks, during which time it was used by approximately 55,000 cars and light trucks. It was set up on one side of the street only and hence was used solely by southbound traffic. There are four churches within a radius of two blocks from this intersection, and as a result, Sunday morning usually finds the roads jammed with religious congregations all trying to make services at the same time; the traffic statistics for Sunday morning are, therefore, of especial interest.

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A CORNELL ENGINEER SURVEY

THE ENSIGNS LOOK AT CORNELL

ALL the ensigns were enrolled in colleges or technical schools before entering the Naval Reserve. They were principally from the South and the Middle West. The geographical locality from which the ensigns came was a factor in determining their answers to questions. For the most part these men, many of whom were law students, had no engineering training whatsoever before coming to Cornell to study Diesel engines.

Twelve men were interviewed; of these, two formerly attended Manhattan, two, the University of Illinois, one, Worcester Polytechnic Institute, one, the University of North Carolina, two, Virginia Polytechnic Institute, one, the University of Wisconsin, one, William and Mary, one, Dartmouth, and one, Trinity. It was the opinion of these men that feeling was generally the same among the ensigns on the important questions asked. We therefore feel that this poll is a reasonably accurate barometer of ensign opinion.

The questions asked and the answers given are listed below with a short discussion of the answers.

Question: What is your opinion of the course of study: very favorable, favorable, or unfavorable?

Answers: Very favorable 5
Favorable 7
Unfavorable 0

Opinion was unanimous that the course of study was of great value; however, those who gave their opinion as being "favorable" commented that they thought that there was too much emphasis on theory. Nevertheless, they realized that they were unfamiliar with engineering and that no doubt the material studied would be of use to them at some time or other. An opportunity is offered the ensigns at the end of the course to offer suggestions for improvement in the course.

Question: What is your opinion of the instructors—very favorable, favorable, or unfavorable?

Answers: Unanimously very favorable.

All men queried were emphatic in their praise of their instructors and were impressed by their patience and willingness to cooperate at all times. One ensign was especially impressed with the thoughtfulness of one of the teachers who, after teaching all day, still found time to hold daily afternoon teas for the Naval men. All the ensigns felt that they could ask for nothing better in the way of instructors.

Question: What is your opinion of the equipment: very favorable, favorable, or unfavorable?

Answers: Very favorable 10
Favorable 2
Unfavorable 0

All felt the equipment used was excellent. Some expressed the belief that more engines could be used and that the space was too crowded. Several would like to have worked on the same engines all the time, rather than on a different type each week; but they realized that a knowledge of the operation of all types of engines is essential. To the ensigns, one of the high points of their course is the weekly trip to Auburn where they get practical experience with Diesel engines under the guidance of Dr. Hart Cooke, considered by many as America's foremost authority on Diesel engines.

Question: What is your opinion of the coeds: very favorable, favorable, or unfavorable?

Answers: Very favorable 10
Favorable 2
Unfavorable 0

The coeds met with favor everywhere; the men were particularly pleased by the generous hospitality extended by the coeds in the form of sorority open houses and dances. However, several ensigns were disappointed in the attitude of the W.S.G.A. concerning the farewell party the present group held out of town February 21; they wondered if jealousies had entered into

INTRODUCING

AS a new feature of the CORNELL ENGINEER, we are beginning a series of surveys in an effort to represent the opinions of a representative group of engineering students on current matters of importance.

This survey was conducted among the Naval Ensigns at Cornell in an effort to determine their attitude toward the University. It is hoped that the constructive criticisms set forth in this poll may be used to further relations between the University and the ensigns.

In this poll, the ensigns interviewed were those who completed their four months' training course on March 6.

the decision of the W.S.G.A. not to allow girls out on special late excuses even after the University had given them permission.

Question: What is your opinion of the men at Cornell: very favorable, favorable, or unfavorable?

Answers: Very favorable 2
Favorable 10
Unfavorable 0

This question, aside from the one on expenses, drew the most negative results. The reasons for this were varied. All agreed that the men were agreeable once they got to know them. However, aside from individual cases in which ensigns belonged to fraternities having chapters here, they have found no effort on the part of the men to make them welcome. Several of the ensigns suggested, and all the rest agreed with them, that it would be an excellent idea if fraternities would invite groups of ensigns over for Sunday dinner and the afternoon. This could be easily arranged and while taking neither a pro or con stand on the question, the CORNELL ENGINEER believes that it is a matter worth considerable thought. Many agreed that a sore point in relations was the question of coeds, the University men feeling that they were being cut out. In answer, the ensigns pointed out that their stay here is short and that most of them have steady girl friends at home. The Southerners were impressed by the lack of mutual cordiality, but conceded that this was typical of all Northern colleges. It is interesting to note that the ensigns were well received by the Juniors and Seniors but found the lower classmen inconsiderate of the uniform, now and then passing off uncalled-for remarks, and resorting to such childish tricks as hat-stealing. Another example of thoughtlessness on the part of the University students was exhibited when they tried to gain entrance to local theaters dressed as officers for the reduced admission price. This resulted in the price being made the same for everyone, ensign or not. The ensigns have, however, found Cornell men as a rule to be agreeable and easy to get along with when once they have gotten acquainted with them.

Question: Does Cornell compare very favorably, favorably, or unfavorably with previous places you have been stationed at?

Answers: Very favorably 8
Favorably 2
Unfavorably 0
No comment 2

Before coming to Cornell for the four months' training course, all the ensigns, with the exception of four, had been stationed at the U. S. Naval Reserve Midshipmen's School at Northwestern University for three months. They were then transferred to the Boston Navy Yard where they remained for six weeks. While in Boston they were engaged in local defense work. Those who replied 'favorably' to the question preferred a bigger town where there is more activity. Many thought that Ithaca was the best place that they could be stationed and that they had been given more to do here outside of regular work than in some of the larger cities. All thought Cornell has the most beautiful campus they have seen.

Question: Do you seem welcome on the Campus—yes or no?

Answers: During first week
Yes 3
No 9
At present
Yes 12
No 0

Many of the present group did not expect to be particularly welcomed to the Campus as they were coming here for defense training and saw no reason why they should be taken in by the University community. They were pleasantly surprised to find that social events had been planned for them by the coeds, the graduate faculty group, and Willard Straight Hall. It was pointed out that for the first two weeks the ensigns do not have as much homework as later in the course and consequently have more free time for social activities, yet a great many of the parties planned for them have been after these first two weeks, and then they do not have time to go to all the functions they are asked to. It was the general consensus that it was very friendly here — "especially across the gorge", as one ensign put it.

—Alumni News

The Ensigns at work on a Diesel.

Question: Do you find expenses reasonable or unreasonable?

Answers: Room Board
Reasonable 5 Reasonable 6
Unreasonable 7 Unreasonable 4

When compared with Boston, every one interviewed agreed that expenses were much less for both room and board. Those who did think expenses were too high complained chiefly about the high room rent. This was almost unanimous whereas only a few remarked about the cost of food. A humorous side of the expense question was in regard to the pay telephone, a slot

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CORNELL SOCIETY OF ENGINEERS

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GEORGE N. BROWN, *Executive Vice-President*
55 Liberty St., New York, N. Y.
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322 Farmer St., Syracuse, N. Y.
EZRA H. DAY, *Vice-President*
1081 Broad St. Sta. Bldg., Philadelphia, Pa.
J. PAUL LEINROTH, *Vice-President*
80 Park Place, Newark, N. J.

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the College and the alumni."

President's Message

Fellow Engineers:

This letter will have more to do with those who will immediately graduate and begin their engineering careers, but its implications are also applicable to those who may have completed a part of their careers.

The changes made in school procedure by war are bringing many new thoughts to those who are most affected by them. The speed-up incident to the production of engineers follows directly on the speed-up in material production. Continuous sessions of universities and colleges will be new in name only, since summer schools have been so fixed a part of college life for so long a time, that around-the-calendar operation will be nothing new, save to those students who may be forced to give up a vacation, and those on the faculty who have been accustomed to a leisure summer. Who knows—it may be the end of a regime, for it is difficult to demonstrate logically the need for school and college vacations for the present long periods.

But there are many new things which are coming with this new change. Many of the students who will find their school days at an end earlier than they anticipated, or those who, taking advantage of the more rapid progress, begin knocking at the door of opportunity at an earlier age than normal procedure would permit, will have problems to solve which they may have failed to observe during their student days. Complications are involved through the operations of the Selective Service Act.

Perhaps it may be well to give some passing thought to this and to the effect which it may have on a student's life. First, the draft will modify many intentions, good and bad, and may bring the turning point in careers. It offers, on the other hand, opportunities which may have been completely overlooked. This war will take men to the far corners of the earth, where many of them probably never dreamed they would be. The observing student, even though deeply mired in the devastations of war, can, if he will, begin the formation of his future life, for the war will end some day. So, if these men will observe the places in which they may be, they may find the outlet for their knowledge and practice.

Second, because of particular skill or special adaptability, some students may find that they will be called into the production line immediately—a phase of war as important as the front line. What a field this is, and what a tremendous opportunity for development of new skills, new ideas, new thoughts! Perhaps in the pellmell rush which all-out war creates, these things are sometimes completely overlooked. Vast reservoirs of opportunity for research are thrown wide open, with substantially unlimited resources with which to conduct such research available. Cost becomes secondary; necessity prods hard. So here too is an opportunity which must be studied by those who are adapted to it. It is not an opportunity for the laggard, for the "get-ter-by"; it entails serious hard work, long hours, and no short days or weeks. To thinking men this is indeed an opportunity.

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A LUNCHEON meeting of the Philadelphia Regional Group of the Cornell Society of Engineers, attended by over seventy-five members and their guests, was held at the Engineers Club in Philadelphia on Wednesday, February 4.

The chairman of the meeting was Regional Vice-President Ezra H. Day '19. He introduced Lieutenant Seward Baldwin, Jr., '28, of the United States Navy, and he in turn introduced the principal speaker, Lieutenant Daniel R. Duff, Gunnery Officer of H.M.S. Manchester. Lieutenant Duff gave an interesting and entertaining talk on "Some Aspects of the War at Sea." He told something of the procedure in convoy and patrol duties and enlightened the "landlubbers" on life at sea on a warship. Even with the restraint necessary in dealing with this subject in public the talk was very well delivered and enthusiastically received.

Chairman Day concluded the meeting with the appointment of a nominating committee to report at the next meeting, at which the election of officers will be held.

THE CORNELL ENGINEER PRESENTS

Raymond F. Howes '24

PUBLICITY man, promoter, speaker, English teacher, writer, editor, and journalist—such are the varied accomplishments of Raymond F. Howes '24, formerly assistant to the Dean of the College and still instructor in Engineering Journalism. While a student in the College of Arts and Sciences at Cornell, he took an unusually active part in activities. He was managing editor of the Cornell Era and was one of the founders of the Literary Review of Cornell. His summers were spent working on the Elmira Advertiser and the Elmira Telegram. As president of the Freshman Debating Club, a varsity debater for three years, member of the Owls Debate Club, and one of the six chosen in his senior year for the '94 Memorial Stage, he fashioned a background which perfectly fitted his chosen vocation.

From 1924 to 1926 Mr. Howes served on the faculty of the University of Pittsburgh and in 1926 he assumed a position as an instructor of English at Washington University. Three years later he was made an assistant professor in the same institution. It was at about this time that his talents as a publicity man first began to show. He organized the News Bureau at Washington University and was made editor of the new Alumni Bulletin.

Ray

His successes at Washington University led directly to his assumption of the position of assistant to the executive secretary of the Cornellian Council at his alma mater in 1936. This Council was the fund-raising agency of the University, and his special job was the publicity and promotion of this organization's activities.

In December of 1937 S. C. Hollister was appointed Dean of the College of Engineering, and one week later Mr. Howes became his assistant. His job was still directed partly along publicity channels. The College of Engineering needed an increased enrollment and an increase in funds; so he undertook promotion programs to meet these needs. This work had, as one of its various phases, the position as technical adviser for the CORNELL ENGINEER. In this capacity he has done much for the magazine, one of his contributions being the initiation of a class in Engineering Journalism for the magazine's board members.

Last August he assumed the position of assistant to the Provost, his work still dealing with fund-raising, especially the preparation of special publications concerning the work of various divisions of the University.

Since coming back to Cornell, Mr. Howes has published several books, *Our Cornell* being a familiar one on the campus. Another, of interest in the fields of public speaking and English literature, is entitled *Coleridge the Talker,* done in colloboration with a professor at Wells College.

Besides these activities, Mr. Howes is a member of Omicron Delta Kappa, the American College Quill Club, the Modern Languages Association, the National Association of Teachers of Journalism, Delta Sigma Rho, Sigma Delta Chi, the National Association of Teachers of Speech, and, locally, the editorial staff of the Cornell Alumni News and the Board of Directors of the Southside Community Center.

Kenneth E. Rose

ALTHOUGH a member of the Cornell faculty for more than a year now, Kenneth E. Rose has only recently come to the campus. Associated with the Engineering Science and Management Defense Training courses in Buffalo since the first of January, 1941, Mr. Rose

Ken

was called to Ithaca the first of February this year and is now serving as an assistant to Professor Adams, his official title being an administrative assistant with the E.S.M.D.T.

Born in Winfield, Kansas, Mr. Rose spent his youth there and upon graduation from high school attended Southwestern College for two years without leaving home. Then, lured on by a desire for experience in the West, he travelled to southwestern Colorado, where he worked during 1936 and 1937 on a construction project as a junior engineer. When this work was completed, he decided to continue his education at Colorado School of Mines.

Besides being an excellent student, Mr. Rose participated in many extracurricular activities; he was on the Student Council, president of the band, a junior member of the Colorado Society of Engineers, and a student member of the

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THE STUDENTS . . .

Fred Guterman, AE '42

EVERYONE knows Fred Guterman. Some know him as a man-about-town; many think of him as a man of many activities; still others know him as a student. This popular, personable little fellow has, in his three and one-half

Fred

years here, accumulated one of the widest circles of friends and acquaintances on the Hill, for he likes people—all kinds of people—and it was his desire for the opportunity to meet and deal with people that brought him to Cornell.

The balanced curriculum of the AE course attracted Fred after his graduation from high school in his home town of West Newton, Mass. His freshman record was excellent, and earned for him a McMullen Scholarship. It was during his frosh year that Fred began his long and successful association with the Cornell crews, of which more will be said later.

After spending the summer following his freshman year as caddymaster at a country club, Fred returned early to Ithaca and went to Freshman Camp as a counselor. He continued to make an excellent scholastic record during his sophomore year, while being active as coxwain with the JayVee Crews, skiing in his spare time, and participating in intramural athletics. It was at the Poughkeepsie Regatta that year that Cornell's Guterman-coxed shell was the only one not to founder in the ill-fated JayVee race. Fred worked that summer on a toy manufacturer's assembly line, and again returned early for Frosh Camp.

Continuing his fine work as a junior, Fred entered the ROTC Ordnance course, became a member of the Officers' Club, and was elected to Kappa Tau Chi and Quill and Dagger. Among other honors which have become his in the last two years are Tau Beta Pi, Scabbard and Blade, and Kappa Beta Phi.

Fred's first love at Cornell has always been the Crew. In spite of a throat affliction which prevented his active participation as a coxwain last season, and which this year threatens to do the same, he was down at the boat-house every day or working out at the Old Armory before the lake was open. It was fitting that Fred should recently have been elected president of the Crew Club. The eight-oared shell, however, is not his only interest in boats, for he has spent a number of summers off the Maine coast aboard charter boats, fishing vessels, and sailboats; and at one time he was active in the Cornell Corinthian Yacht Club.

One of the outstanding things about Fred is his wonderful sense of humor. His battered "bowler", rim-less straw hat, and far-from-quiet cowbell are well known both on and off the Hill, while within Sibley, many are the jests and jibes traceable to him. There was, for exampe, the time that Fred put a large, polished red apple on the table before Professor Bangs entered to begin class. The Professor came in, regarded the object, beamed at the assembled class, and then lifted the apple, only to discover that it was but a shell, the inside having been eaten away.

Those who know him well are quite aware that Fred's humorous side is balanced by a seriousness of purpose and outlook. He wants to do creative, original work with people and with ideas. Monotony of any sort is distasteful to him, and he delights in getting a job done and moving on to another different task. Fred is looking forward to his coming service in the Army, but hopes, when the war is over, to travel extensively, working here and there at various diversified jobs as he goes along.

Harry St. John, AE '42

A LOVER of mechanical things from his boyhood, Harry St. John, Jr., came to Cornell to study engineering because it seemed the natural thing to do. His liking for machines and a natural ability in mathematics seemed to indicate that a technical school would benefit him most; and since his father

Harry

is a Cornellian of the class of 1910, Harry decided to follow in his father's footsteps. Because he hopes eventually to get into the management field, Harry entered the AE school.

Before he began his freshman

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THE ALUMNI . . .

Author

CHARLES D. Young, M.E. '02, who is now vice-president of the Pennsylvania Railroad in charge of Real Estates, Purchase, and Insurances, is the author of an article on "Mechanical Engineers in the Transportation Emergency", which appeared recently in *Mechanical Engineering*, the official publication of the American Society of Mechanical Engineers.

According to the author, many engineers are living and working with the textbook of today instead of writing the textbook for tomorrow, as they should be doing in any emergency. The problems that war thrusts upon us must be met with engineering ingenuity and with the pioneer determination to solve the problem with the materials and tools at hand.

At Cornell, Mr. Young was active in athletics, being captain of the track team and colonel of the cadet corps. Since graduation, he has served continuously with the Pennsylvania Railroad. Very active as an inventor of many railroad devices, Mr. Young is noted for his locomotive superheaters.

President

FREDERICK E. Munschauer, M.E. '07, was recently elected president of the Niagara Machine and Tool Works, Buffalo. He had previously been secretary and treasurer of that company for twenty-nine years.

At the same time George E. Munschauer, M.E. '27, his nephew, was elected treasurer of the same company. He was a member of Scalp and Blade while at Cornell. After graduating, he became test engineer of the Worthington Pump and Machinery Corp., and in 1937 he was made chief engineer of the Niagara Machine and Tool Works.

ACFC Promotion

JOHN W. Sheffer, M.E. '07, has recently been appointed general electrical engineer of the American Car and Foundry Company.

He began his association with the company in 1908 at the Berwick plant, acting first as electrical engineer and later in the capacities of assistant to the general superintendent and plant engineer. During these seventeen years he was engaged also with welding developments of all descriptions, and was particularly responsible for the development of the Berwick Electric Rivet Heater.

John W. Sheffer

In 1926, Mr. Sheffer was transferred to the New York office and since that time has been occupied with improvement and development problems in the several plants. Major welding installations have been made at five plants. In 1933 he obtained an M.A. degree from Cornell University.

Mr. Sheffer holds memberships in the American Institute of Electrical Engineers, American Welding Society, Iron and Steel Engineers, and Cornell Society of Engineers.

Superintendent

ROBERT R. Thompson, M.E. '34, has been made superintendent of the Proctor and Gamble Manufacturing Company's plant in St. Benard, Ohio. He has been associated with this company ever since his graduation. Among the positions he has held are foreman, process supervisor, and production supervisor. At Cornell Mr. Thompson rowed on the varsity crew and was a member of Red Key, Atmos, Quill and Dagger, and Tau Beta Pi.

Navy Wings

PHILLIP Lawrence Reynolds, M.E. '41, last week joined the ranks of America's young college men who are serving their country as flying officers in the Navy.

After successfully completing a seven-month course at the Jacksonville Naval Air Station, Reynolds was commissioned an Ensign and awarded the coveted Navy "Wings of Gold." He is now prepared to take his place in the nation's fighting line.

Ensign Reynolds went through elimination training at Floyd Bennett Field, N. Y., before reporting to Jacksonville last May. There he joined a corps of fledgling pilots who must master the mechanics of aviation as well as the technique

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Use The Cornell University Placement Bureau

WILLARD STRAIGHT HALL — H. H. WILLIAMS, '25, Director

FROM THE COLLEGE . . .

Pre-Naval Training

On February 2, 1942, a pre-Naval Training Program was begun for the benefit of Cornell students who had registered in any of the Naval Reserve programs. The course was originated by Dr. A. S. Adams, Assistant Dean of the College of Engineering, and Professor A. D. Seymour of the College of Architecture. The purpose of this course is to prepare Cornell students for the training which they will soon get at either Annapolis, Northwestern University, or on the training ship, Prairie State. There is generally a considerable number of scholastic fatalities at the completion of the advanced training courses, and it is hoped that this introductory course will help Cornell trainees to be exceptions to the rule. The course is entirely informal and is not given for University credit. Therefore, classes are held after school hours, at 4:15 on Monday and Wednesday afternoons in the main lecture room of Franklin Hall. Student attendance is voluntary, and at present there are about fifty names on the roll. Several professors are generously giving their spare time to this project. Professor Loberg, of the Department of Administrative Engineering, an Annapolis graduate, is giving several lectures on Naval traditions. He also will give lectures on Elementary Gunnery in conjunction with Lieutenant Marcoux, who is in charge of the ensigns taking the course in Diesel Engineering. Assistant Professor Kellogg of the Ornithology Department, who has had considerable experience in air navigation, and Professor Seymour, who held a commission in the Naval Reserve during the last war, are giving lectures on chart construction, navigation, and the rules of the road. Professor Seymour is also giving lectures on Naval ships and on simple sailing, including the plotting of courses and the computation of distances. The pooling of the talents of these men from entirely unrelated divisions of the University is typical of all the war programs which are being carried on at Cornell.

The course will run until about the middle of May. Toward the end of the term it is hoped that the students may obtain some practical experience in sailing, navigation, and rules of the road by spending some of their Saturdays on boats on Cayuga Lake.

Chem Engineering And War

A large audience greeted Professor F. H. Rhodes, Director of the School of Chemical Engineering, and Associate Professor C. C. Winding of Chemical Engineering at the last meeting of the AIChE. Professor Winding, in his address, pointed out the position of the chemical engineers in the present Selective Service System. He said that not many chemical engineers had been drafted, and read several memoranda from Director Hershey of the Selective Service Board in Washington, urging that all vital engineering students be considered for deferment. He also gave the audience a few points on the new draft registration. Professor Winding is a member of the University Committee for Counseling for Student Defense and therefore was well qualified to speak on this subject.

Professor Rhodes then spoke on the new attitude of the faculty towards student engineers, in that they now feel that they have to produce good ones for the present emergency. No more favoritism nor babying is to be tolerated.

ATMOS ELECTS

At a recent meeting, Atmos, the junior honorary engineering society, elected the following men of the class of '43 to membership:

Wallace R. Seely
William H. Sens
John F. Harper
Clyde H. Loughridge

New Ensigns

Twenty-five additional ensigns of the U. S. Naval Reserve arrived at Cornell on the morning of February 9 to begin a new rescheduled special course in Diesel engines. They were welcomed by Assistant Dean Arthur S. Adams at a meeting in the Engineering Laboratory Annex, thus initiating the new scheme of the course. Previous to their arrival, the University took fifty ensigns every 16 weeks. However, it was soon discovered that time and space could be used more economically if smaller classes were to overlap each other. So now, at the request of the Navy Department, the College has agreed to accept 25 ensigns every five weeks, there being a total of 75 in residence all the time after the program gets under way. A goal of 100 ensigns has been set up.

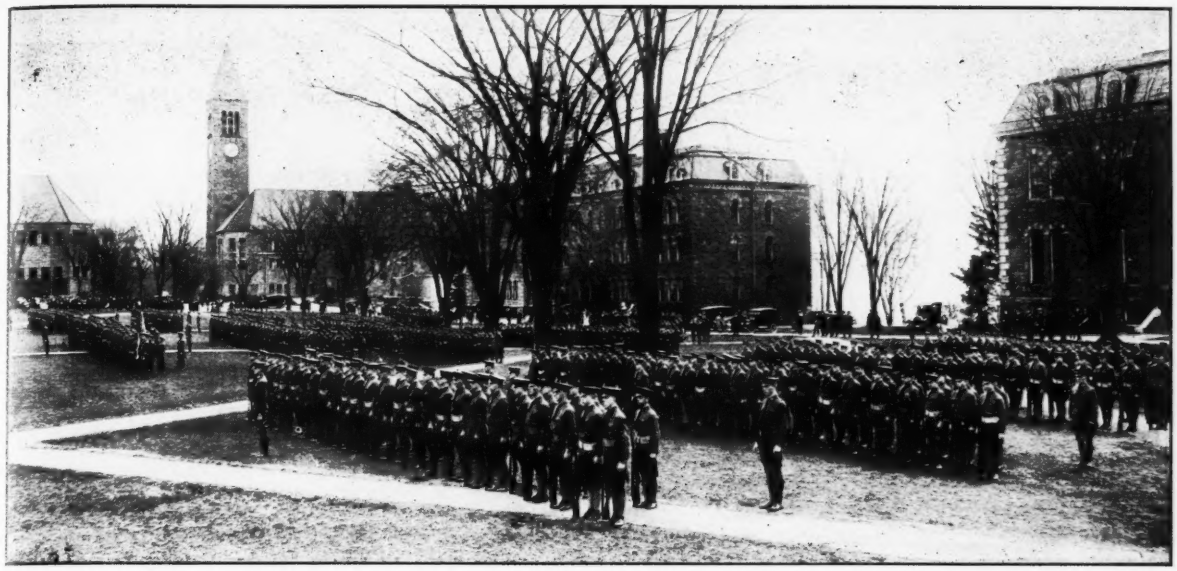
Another group of 25 ensigns arrived here on March 16, thus bringing the present total to 50. The next group of 25 will arrive here on April 29.

The purpose of this 16 week intensive course is to qualify the men to act as engineer officers on patrol vessels and other small craft with the fleet. Dr. Adams said that the more than 100 ensigns who have completed the course are now on active duty and that their records with the fleet are a matter of pride to Cornell as well as to the Navy.

Instruction in the Diesel engine course, which has the support of the U. S. Office of Education, as well as that of the Navy Department, is conducted by a special staff in the College of Engineering under Professor A. C. Davis. This staff has been recently expanded to include on the electrical engineering staff Professors L. A. Burckmyer, W. E. Meserve, M. G. Northrop, and their assistants. A new instructor on Diesel engines is Mr. S. K. Wolcott, M.E. '36.

The first floor of the Engineering

(*Continued on page* 18)



WE CAN do it aggain," may be the watchword of the war effort, but so far as Cornell is concerned, we are not doing it in the same manner. In 1918, 2000 Cornellians were members of the Students' Army Training Corps. Living under Army subsistence and discipline, their training was primarily military. Shown above is the SATC unit drawn up on the campus for review. Upon completion of the required training, these men were assigned to various training centers as the Army's immediate needs required. A large percentage of them were sent to officers' training schools.

Today, however, with the urgent need for trained men in the production program and for technical officers in the armed forces, Cornell's program is different. While continuing their college courses unchanged, 211 seniors and 170 juniors are being trained as officers in the advanced course of the Reserve Officers' Training Corps. The front cover picture shows a group of these men working on a field artillery problem. Upon graduation they will receive their commissions as Second Lieutenants in various branches of the Army and will immediately go into active duty. Since 1919 and including this year, 2328 Cornellians will have received such commissions.

At the same time, 1298 freshmen and 1010 sophomores are being trained in the basic course of the ROTC. The freshmen pictured below are being instructed in artillery preparatory to actual gun drill. Designed to give them the elements of military science and tactics, this course is an excellent means for discovering potential officers and for acquainting students with military life.

In contrast with the methods of 1918, today the aim is to carry on, side by side, the work of training completely educated officers as well as men for non-military positions. LIFE Photo

REPRINTED BY POPULAR REQUEST

WHO is the man who designs our pumps with judgment, skill and care?
Who is the man that builds them and keeps them in repair?
Who has to shut them down because the valve seats disappear?
It is the bearing-wearing, gear-tearing Mechanical Engineer!

WHO makes his juice for half a cent and wants to charge a dime?
Who, when we've signed the contract, can't deliver them half the time?
Who thinks a loss of twenty-six per cent is nothing queer?
It is the volt-reducing, load-reducing, Electrical Engineer!

WHO is it who takes a transit out to find a sewer to tap?
Who with care extreme locates the junction on the map?
Who is it who goes to dig it up and finds it nowhere near?
It is the mud-bespattered, torn and tattered Civil Engineer!

WHO thinks without his products we would all be in the lurch?
Who has a heathen idol which he designates Research?
Who tints the creeks, perfumes the air and makes the landscape drear?
The stink-evolving, grass-dissolving Chemical Engineer!

WHO is the man who'll draw a plan for everything you desire?
From a trans-Atlantic liner to a hairpin made of wire?
With "ifs" and "ands", "howe'rs" and "buts", who makes his meaning clear?
The work-disdaining, fee-retaining Consulting Engineer!

WHO builds a road for fifty years that disappears in two?
Then changes his identity so no ones left to sue?
Who covers all the traveled roads with filthy, oily smear?
The bump-providing, rough-on-riding Highway Engineer!

WHO takes the pleasure out of life and makes existence hell?
Who'll fire a real good looking one because she cannot spell?
Who substitutes a dictaphone for a coral-tinted ear?
The penny-chasing, dollar-wasting Efficiency Engineer!

—An Obliging Alumnus

THE COLLEGE . . .

(*Continued from page* 16)

Laboratory Annex has been reconstructed to include four new classrooms for the Diesel course, making a total of five in all. In addition, two recitation rooms and an engine lab have been constructed in the West Mechanical Laboratory. A large room is also being added to the West Mechanical Lab for instruction on the maintenance and overhaul of the engines.

The course now has the use of a number of different engines, among which are one General Motors 3-cylinder Diesel, one 4-cylinder marine type 140 H. P. Fairbanks Morse engine, one 4-cylinder Caterpillar Industrial engine, one 3-cylinder 400 H.P. supercharged American Locomotive Company Diesel, and one McIntosh Seymour 2-cylinder air injection type engine. More engines are coming, and those that are already here are plentifully equipped with spare parts and accessories.

Thus the course in Diesel engines is no longer in its infancy, but is operating and equipped to produce well-trained ensigns, men who are able to cope with engineering problems in the small vessels of our fleet.

Dean Visits Florida

DEAN and Mrs. S. C. Hollister have just returned from a vacation in Florida. Dean Hollister was a victim of a serious automobile accident last December, in which he suffered a broken shoulder and ankle and other injuries. His recovery has been steady, and since his return he has resumed his duties in the Engineering College.

Aerial Photography

AT A meeting on Tuesday, February 24, Sherwood G. Holt '43 spoke, describing the technique of aerial photography. His lecture covered the type of camera used, the plane and its equipment, the method of aligning the camera while taking pictures, and finally the methods of printing and assembling the prints. He illustrated his talk with a few sample photographs.

A. Francis Binder '43, spoke on a rational method, of parachute testing. Robert Barker '43, was appointed publicity chairman.

THE ALUMNI . . .

(*Continued from page* 15)

of flying before receiving Navy Wings. In addition to hours of interesting training in the cockpits of the many types of Naval aircraft, Reynolds took courses in the Jacksonville Ground School, where he learned about engines and plane structure, instrument and celestial navigation, gunnery, communications and weather conditions.

Naval Cadet

WILLIAM Arthur Miller '40, received his appointment this week as a full-fledged Aviation Cadet at

the U. S. Naval Air Station, Jacksonville, Florida.

As a second-class seaman, he was given preliminary flight training at the Naval Reserve Air Base, Floyd Bennett Field, Brooklyn, N. Y., before being sent to the Jacksonville Naval Air Station.

Railroadman McNear

GEORGE Plumber McNear, Jr., M.E. '13, has achieved the unique status of personally owning a class one railroad, the Toledo, Peoria, and Western. Before he bought the road in 1926, for $1,300,000, it had long been defunct; in every year of his management the road has made money.

T. P. & W. cuts straight east and west across Illinois. At Keokuk, Iowa, and Lomax, Illinois, it connects with the Burlington and Santa Fe. The eastern terminal, at Effner, Indiana, meets the Pennsylvania; en route it crosses practically every western road. Transcontinental shippers route their cars via T. P. & W., thereby bypassing the congestion of Chicago terminals. Most of the road's business is short-cutting freight, its gross annual revenue running above $2,500,000. Its passenger revenue only runs about $75 annually, since most of the passenger fares are from thumbing, caboose-riding farmers.

In 1940, the Railroad Brotherhood started negotiations. They wanted the same featherbed rules as they had everywhere else. McNear was meanwhile demanding a schedule that would produce more money per year for the workers, and lower the unit costs for himself. His formula was to let the employees do more work, and forego all featherbed rules. Pearl Harbor averted a strike called for December 9th, 1941. A little less than fifteen per cent of the workers struck on December 28th, and as this goes to press, McNear's road is still operating on a practically normal service basis.

Cornellian In DIO

JAMES S. Knowlson, E.E. and M.E. '05, now heads the DIO—Division of Industry Operations—which will become increasingly important in speeding up defense production. Before going to Washington to become Donald Nelson's right hand man, he was president and chairman of the board of the Stewart-Warner Company, Chicago. Previously he had been manager's assistant at the General Electric Company's Schenectady Works and business manager of the Electro-Magnetic Tool Company, Chicago. He is president of the Radio Manufacturers Association.

(*Continued on page 26*)

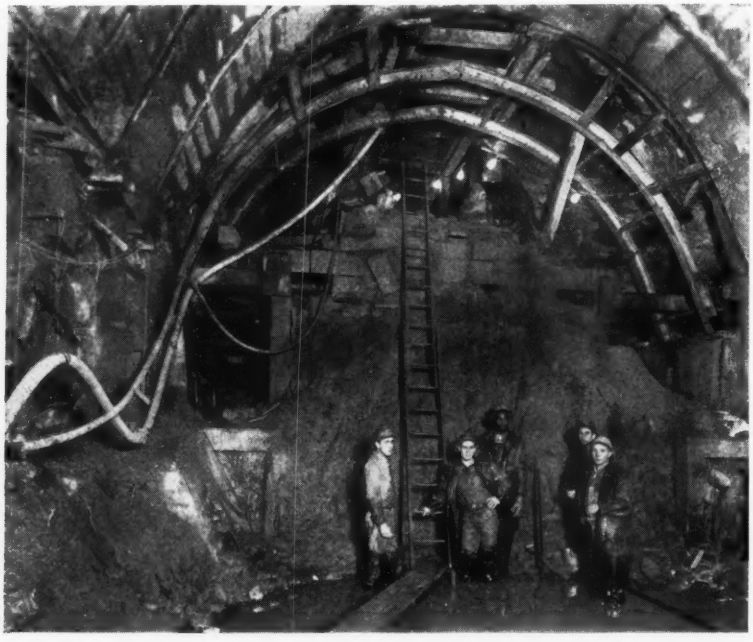
CLASS OF 1942, SCHOOL OF CHEMICAL ENGINEERING

1. Percy, W. R., Inwood, N. Y.
2. Ruden, S., Atlanta, Ga.
3. Hollister, S. C. (Dean)
4. Weikart, J., Baltimore, Md.
5. Green, E. J., Providence, R. I.
6. Lee, L. V., Washington, D. C.
7. Chrzan, L. R., Olean, N. Y.
8. Gertzog, I., Rochester, N. Y.
9. Miller, W., Elmira, N. Y.
10. Sullivan, F. C., Buffalo, N. Y.
11. Ryan, N. W., Casper, Wyo.
12. Nicoll, W. O., Scotia, N. Y.
13. Hathaway, F. S., Upper Montclair, N. J.
14. Meyers, J. M., Sodus, N. Y.
15. Borst, J. R., Utica, N. Y.
16. Herrmann, R. H., Garden City, N. Y.
17. Hinrichs, H., Staten Island, N. Y.
18. Robinson, W. F., Garden City, N. Y.
19. Smith, J. C., Westmout, Quebec
20. Finn, R. K., Arpin, Wisc.

Delaware Aqueduct

(*Continued from page* 8)

of flow regulation will be Kensico, with West Branch as a secondary regulator. The long lengths of pressure tunnel make it necessary to change the flow rate slowly if surge troubles are to be avoided. Because of its great length of 45 miles, the Rondout to West Branch tunnel is expected to be used for nearly constant flow rate for considerable periods of time. Weekly or seasonal variations can be taken care of here. The capacity of the West Branch and Kensico reservoirs together is sufficient to permit this. Considerable study has been given to surge problems in designing control equipment. For the most part the problem has been solved by assigning certain maximum rates of flow rate change, these being low enough so that the resulting small surges will be taken care of without any special equipment.



Tunnel construction, finished diameter 19½ feet, inside concrete lining.

Control equipment for regulating valves and sluice gates has been designed with these points as determining features. To this end such valves and sluice gates are operated by means of hydraulic cylinders with oil as the operating fluid; the oil pumps are to be of such size and type that the operators cannot exceed the maximum allowable rate of opening or closing. The magnitude of the job is indicated by the number of large units incorporated into the work. For instance, there will be 8 conical plug valves of 42-inch size, four of 54-inch size, and three of 64-inch size. Sluice gates in large number include sizes such as 5 feet by 15 feet and 6 feet by 15 feet. Elaborate precautions have been taken to make it possible to take any of these out of service for inspection and maintenance with little or no interruption in delivery of water.

Except for the instance cited above, tunneling operations were carried on with little difficulty except as is customarily found in this kind of work. In the total length of 85 miles many different geological formations were encountered; construction methods and design were varied to meet the conditions encountered. Thirty-one shafts were driven from ground level to tunnel elevation, varying in depth from 313 feet to 1551 feet, with an average of 623 feet. Tunnel was driven in both directions from most of these shafts. This work was divided into some fifteen contracts and, as might be expected, methods varied between the various contractors, not only in shaft sinking and tunnel driving but also in the concrete work of lining the finished bore. Separate contracts for the manufacture of equipment such as valves, sluice gates, building equipment, and controls have been and are being awarded.

Aside from ordinary water service for buildings and drainage of waterways for ordinary maintenance, the only pumping problems are those involved in unwatering the tunnels for inspection after the first testing period. Provision is made for the installation of pumps for this purpose at those points where the tunnels reach their lowest elevations. These pumps will later be available for unwatering the tunnels if the need should ever arise. Past experience indicates that this will not be likely; the only excuse for the installation is the far-sighted policy of making provision for all possible eventualities.

Traffic Solution

(*Continued from page* 9)

When a traffic count was made from 7:00 a. m. until 9:15 p. m. on Sunday, August 17, 1941, it was found that in this 14-hour period 4685 cars and light trucks went over the overpass and 1581 took the alternate two-lane level route, on which the traffic light is green two-thirds of the time. As a result there was no traffic tie-up; the complete elimination from the intersection of approximately 5000 cars made the difference between a bad traffic jam and a smoothly flowing stream of traffic. This and other checks show rather well that one overpass, by diverting 74 per cent of the traffic from one lane, eased conditions for all traffic at the intersection.

The overpass has its economic implications, since in those fourteen hours it eliminated 1893 stops. Traffic experts estimate loss due to traffic stops at 1½ cents a minute; at this rate, one overpass at a busy downtown intersection could save more than 25 dollars worth of drivers' time during the course of a day.

The actual installation time of the overpass is about three hours.

(*Continued on page* 22)

More aluminum up there, less in new telephones —for victory!
Many materials used in telephone making are listed as "critical" for war purposes. Bell Telephone Laboratories and Western Electric have redesigned apparatus and changed manufacturing methods to employ available materials.
Take aluminum. The reduction in its use in a year's telephone output is enough to build 294 combat planes. This program has been replacing critical materials at an annual rate of 7,747,000 pounds. Though it grows steadily more difficult to maintain as shortages increase, the program helps to meet the greatest demand in history for military and civilian communication equipment.
"THOSE PLANES WILL HELP DADDY LICK 'EM!"

Western Electric

. . . is back of your Bell Telephone service

Traffic Solution

(*Continued from page* 8)

A 15-ton truck crane was used to hold the spans in position while they were bolted together. Due to the rough approach and exit to the overpass, caused by abandoned street-car tracks, it was found necessary to build up the approach and the exit of the overpass with asphalt in order to obtain smoother rolling onto and from the overpass. The center span in this case was set at a 10½ ft. street clearance because big trucks were routed around the intersection. This overpass is easily transported from city to city or within cities by a two-ton truck-trailer outfit and is intended to be used as a temporary installation to relieve some emergency traffic problem or as a permanent structure.

This experiment was carried out successfully, in spite of adverse conditions. The overpass was located just on the other side of a blind curve, and the drivers, who were completely unfamiliar with it, had only a few seconds to make up their minds whether to use it or to take the usual route. In addition, as mentioned above, there were old street-car rails leading up to the overpass; yet in spite of these difficulties, there were no mishaps during the three weeks it was in operation.

Looking down the approach

From the standpoint of public use the overpass is a complete success; by relieving traffic tie-ups occasioned when Army caravans pass through large cities, this structure will prevent much inconvenience, annoyance, and loss of time to the civilian population. Whenever they are located in congested areas, they will not only help prevent accidents, but will clear the roads faster by permitting transient business folk to get out of the city more quickly. So don't be surprised if some day while travelling toward town you are confronted by an overpass.

Ensign Survey

(*Continued from page* 11)

machine affair which keeps the nickels whether or not the party is reached. One ensign from the South claimed that wire was unavailable for another circuit which would make the return of the nickels possible. He added, "We're glad to make the sacrifice . . . for national defense." Realizing that everything can not be perfect, they take the few inconveniences good-naturedly.

Question: Do you find ample sources of recreation, when and if you have time for such? Yes or no.

Answers: Yes 11
No 1

Concerning recreation, there are two sources available in particular. One is the law school squash courts, where frequent matches are held between the ensigns and the law students. The other is the Ithaca Y.M.C.A., where the ensigns have a team in the five-man basketball league.

This is the extent of the first CORNELL ENGINEER Survey. We hope that it has brought to light the problems that exist between the University and the ensigns.

Harry St. John

(*Continued from page* 14)

year, Harry had already become acquainted with engineering work through summer employment with a manufacturer of electric furnaces in Detroit, his home city. During a few weeks prior to freshman registration, he and a friend thumbed their way throughout the Eastern and Southern United States, and to climax their trip, purchased a car. It was a vehicle of ancient vintage, and taxed their ingenuity to keep it running. After suffering seventeen flat tires, they decided to run the machine only at night, so that the hot pavement of the highways would not cause so much trouble.

Behind Harry, as he began his first year at Cornell lay a varied and active background. In addition to the aforementioned trip, there were the summers spent at camps, both as camper and counselor, and there were the vacations in Michigan's Upper Peninsula, spent swimming, hiking, shooting ,golfing and playing tennis. Desiring to continue his physical activities, Harry soon found that crew provided the desired exercise and competition. With but one interruption, this association with the Cornell Navy has existed throughout his college career.

This interruption occurred last year, when Harry's duties as director of Freshman Camp caused him to spend his time working to insure its success. Harry had been interested in this work since his frosh year and had participated extensively in it as a counselor. As director, it fell to him to make all financial arrangements, provide for transportation, bedding, entertainment, and all the other elements of the four-day camp season. He in-

(*Continued on page* 24)

The pipe that can't keep a secret...

LEFT: *PYREX Pipe Lines—from 1" to 4" in diameter—are hung much like other types of piping. This picture shows the use of straight lengths, an "L", and two "T's".*

ABOVE: *This close-up of 4" PYREX Piping shows the parts used in a joint: metal flanges, asbestos inserts, and a gasket.*

THIS ginger ale maker is as finicky as a New England housewife. (Probably why his ginger ale is an Eastern best-seller.)

"I want pipe I can see through", he said, "so I know it's clean. Pipe that can't alter the flavor of my product any more than the glass bottles it is sold in. Darn it, I want glass pipe!"

Glass pipe lines, made by Corning, are a familiar sight in food, beverage, and chemical plants . . . paper mills, refineries, explosives factories . . . drug, medicine, and cosmetic plants . . . in short, wherever product purity is vital.

Highly resistant to corrosion attack, Corning's PYREX Piping eliminates this cause of contamination. Transparent, it keeps no secrets . . . a glance tells of flow, cleanliness, color, sedimentation. And freedom from pitting and scaling means long life for these pipe lines, with low maintenance costs.

Important? Yes. For in today's urgent program there's no place for impure products, production stoppage, high maintenance costs, or wasted materials. And in many instances, glass has proved it can outperform metals, do an essential job better and at a lower cost.

To the engineer, this glass piping is important as an example of the many-sidedness of glass in industry and of Corning research in glass . . . research that takes in its stride such divergent tasks as the making of a tiny chemical-resistant glass spring, smaller than your thumb, or the casting of the world's largest telescope mirror, a giant one-piece disc 20 tons in weight. Today more than ever Corning is headquarters for research in glass. Industrial Division, Corning Glass Works, Corning, New York.

CORNING
means
Research in Glass

Harry St. John

(*Continued from page* 13)

terviewed one-hundred and fifty men in order to select twenty-five to be counselors, which is just one example of the work he was called upon to do in his capacity as director. Harry considers these two activities, Crew and Freshman Camp, as the most valuable he has participated in at Cornell.

Besides, the above-mentioned outside interests, Harry has been active in a number of associations and honorary societies. He is the retiring chairman of the Cornell Branch of ASME, and is a member of the Crew Club, Kappa Tau Chi, Red Key, Quill and Dagger, Scabbard and Blade, Tau Beta Pi, and Kappa Beta Phi. Extra-curricular activities have not, however, interferred with his studies, Harry being in the first quarter of his class.

With what little spare time he has, Harry engages in interfraternity sports, representing his house, Sigma Nu, in football, baseball, and hockey.

Kenneth Rose

(*Continued from page* 13)

AIEE. Other honors included election to Tau Beta Pi, Sigma Gamma Epsilon, and Kappa Kappa Psi. In 1936, he graduated from the Colorado School of Mines with the degree of Metallurgical Engineer.

Upon completion of his academic training Mr. Rose took a position as an engineering apprentice with the Caterpillar Tractor Company in Peoria, Ill. There he spent a year and a half working in the foundry, metallurgical laboratory, and engineering departments. Following this, he came to Cornell.

In his capacity as instructor in the Engineering Defense Training courses, Mr. Rose taught mechanics for six months and then physical metallurgy.

Very much interested in music, Mr. Rose has been unable to keep in practice in recent years because of the requirements of his work. When he does get a few minutes, he plays a few strains on the bass viol or bass horn.

Particularly interested in the development of better relations between universities and industry, Mr. Rose has found his work with Cornell a step in that direction and has found great satisfaction in what he is now doing.

Commenting on the beauty of the surrounding country, Mr. Rose says he has suffered "frosh cramps" many a time from climbing the hills around Ithaca. Aside from that evil, he finds Ithaca an ideal place in which to live, even though his desire has always been to work in the West.

President's Message

(*Continued from page* 20)

Third, there is another group, the rejects from the draft. This should not be considered as release, but rather as another chance for real service. There will be many places made vacant in routine life because some one has been called. Many important things will be waiting to

(*Continued on page* 26)

LUFKIN "RANGER" CHROME CLAD
ENGINEER'S TAPE
Engineers who like a durable, compact, easily read steel tape take special note of the Lufkin "Ranger." Its sturdy, flexible steel line is ¼" wide with jet back markings that stand out prominently against the smooth, satin chrome surface. Graduations in feet, tenths and hundredths—or feet, inches and eighths. See it at your dealer's and write for free Catalog 12.
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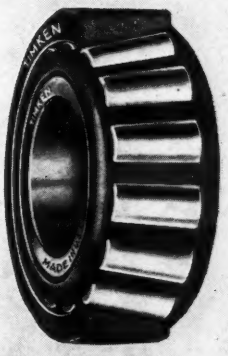

Student engineers of today will have a terrific responsibility in the future; for upon their shoulders to a very great extent will fall the responsibility of developing new and better machines of all kinds to help in the reconstruction of the economic fabric of the nation.

A thorough knowledge of Timken Tapered Roller Bearings will be a valuable asset to every young engineer starting out on his career during the next two or three years—probably the most critical period our country has ever had to face.

Begin to acquire this knowledge now; write for a free copy of the Timken Reference Manual. Then you will be in position to master any bearing problem that may ever come up—no matter what combination of requirements it may involve; friction elimination; radial, thrust and combined load capacity; preservation of alignment of moving parts.

Send for your copy of the Timken Reference Manual today. Mention the name of your school when writing.

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To "KEEP 'EM FLYING"

"Greenfield" Taps, Dies and Gages are helping to build practically every plane and engine used by our Army and Navy.

70 years of practical experience enable these tools to meet Uncle Sam's most rigid requirements. That experience is one reason why skilled workers and production men always have confidence in *"Greenfield"* tools.

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TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

President's Message

(*Continued from page* 24)

be done by those who will not be permitted to shoulder rifles, or to do the thousand and one other things which modern warfare demands. All these can be done by those who cannot go to war. It is fortunate, therefore, that there will be men available for these posts who can bear the burden back home, doing their full share, that those in active service may succeed.

Therefore, the coming commencements bring wonderful opportunities for the graduates. Will they be seized avidly? Time alone can tell. If the vision is there, the fruits of labor may be unbounded; without vision, we shall be mere cogs in the wheel, eventually to be ground down by unremitting operations of the same processes.

THE ALUMNI . . .

(*Continued from page* 19)

Pete Gifford Writes

I AM on my way overseas on a special project for the Air Corps. I came on extended duty October 2, 1941 at San Antonio Air Depot and was there until the middle of January as an Assistant Engineering Officer. I like the work very much, and will be doing somewhat the same work on this project. The work is not very technical as far as engineering goes. It is more production work. My courses in AE help an awful lot, especially Factory Layout. I heartily recommend this work for any of you fellows just getting out. It is with the Material Division of the Air Corps and is *non-flying* work. That is the only bad part; I would love to be flying and may be before it is over.

Until October I was working for my father's company in Sherman, Texas, as an assistant engineer building the Sherman - Denison Basic Training School for the Air Corps. The construction business is very interesting work; I plan to go back to that after the war. I recommend a small company for employment because you get a broader view of the whole company that way.

Stu McKinney '41 is an Engineering Officer in the Naval Air Corps at Pearl Harbor. I have received a card from him since December 7, so he is O.K. Hays Clark '41 is chief engineer on the destroyer . . . on the Atlantic Patrol. Both are Ensigns.

You all get into industry and keep it rolling here while we are slapping the Japs and Jerrys over there. Pete Gifford

NEXT MONTH Professor W. L. Malcolm will describe his experiences as an officer in the engineering corps of the Canadian Army during World War I.

Cecil W. Armstrong, former engineering professor, will discuss the current research work in maintaining sealed, pressure cabins for high altitude planes.

Henry E. Otto, '42 will write on the techniques of drilling oblique wells from shore to tap undersea oil sources.

PREVENTING "TOOTH DECAY" THE MODERN WAY

HERE this hottest flame known to man is giving gear teeth a protective "face." The wearing surface of each tooth is readily flame hardened to an easily controllable depth and to any desired degree of hardness, yet its core retains its original toughness and shock-resistance. Gear teeth, wearing surfaces, shafts, sprockets, and a multitude of shapes of any size and form are economically and speedily hardened this modern Airco way.

Because of its many and varied applications, the oxyacetylene flame has been drafted into service to speed defense by cleaning metal surfaces for quicker and long-lasting paint jobs, by shaping steel faster than ever before, by gouging out metal with astonishing speed and accuracy, and by welding it into a homogeneous, permanent unit.

So that you may become better acquainted with the many industrial applications of the Airco oxyacetylene flame, we have prepared a pictorial review of "Airco in the News".

Write to the Airco Public Relations Department, Room 1656, 60 East 42nd Street, New York, New York for a copy today.

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STRESS and STRAIN...

The colored preacher had just finished his sermon about free salvation and asked a brother to take up a collection. At this, a member of the congregation arose and protested: "Pahson, Ah thought you said salvation was free—free as the water we-uns drink."

"Salvation is free, Brother," replied the parson. "It's free and water is free, but when we pipes it to you—you have to pay for the piping."

—*Excavating Engineer*

* * *

A Miss often becomes a Mrs.
After a courtship and krs.
But man, though he kr.
Remains always Mr.
Oh, what a funny world thrs.

—*Pennsylvania Triangle*

Kid: "I caught my girl friend flirting."

Pop: "That's how I caught mine, too."

* * *

Mother: "Mary, where have you been until 3 a. m.

Mary: "Walking, Mother."

Mother: "For goodness sake!"

Mary: "Yes, Mother."

* * *

To prove: Dry bread is better than wisdom.

1. Nothing is better than wisdom.
2. Dry bread is better than nothing.
3. Therefore, dry bread is better than wisdom. Q.E.D.

Cut Courtesy Excavating Engineer

"Wad'ya mean no swimming! We dug the ditch didn't we?"

A famous biologist, having unsuccessfully tried to show a monkey how to play ball, decided as a last resort to leave the creature alone in a room with a bat and ball. He closed the door and waited a few moments. Then, very quietly, he stooped and peered through the keyhole.

He found himself staring into an intent brown eye.

* * *

She: "Do you know what they're saying about me?"

Engineer: "Why do you suppose I came over to see you?"

* * *

Mechanical Engineer: "Do you know what 'Knee-action' is in a car?"

She: "Yes, and don't you try it."

* * *

Barber: "Haven't I shaved you before?"

Customer: "No, I got that scar in Manila."

* * *

Once upon a time, so the story goes, the fence between Heaven and Hell broke down. St. Peter appeared at the broken section and called out to the devil: 'Hey, Satan," he said, "since all the engineers are over in your place, how about getting them to fix this fence?"

"Sorry," replied Satan, "my men are all too busy to go about fixing measly fences."

"Well, then," replied St. Peter, "I'll have to sue you if you don't."

"Oh yeah," chortled the devil, "where are you going to get a lawyer?"

* * *

Harvey: Is Margie in?
Maid: She's taking a bath.
H.: Sorry, wrong number.

* * *

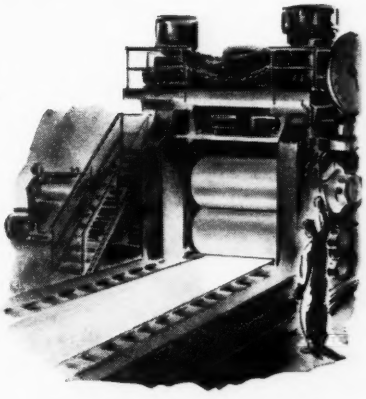
"Who gave the bride away?"

"I could have, but I kept my mouth shut."

What does it take to smooth a Warbird's Feathers?

A wingspread of 212 feet ...every inch preened sleek as satin! The perfect smoothness of the metal sheathing on American warbirds like the B-19, world's mightiest bomber, isn't there for looks. It's essential to top performance. How do they get the flawless sheets of metal used to make airplanes? They're rolled out by the ton by giant steel rolls. And keeping the surfaces of these rolls ground to almost perfect accuracy and finish is another of the vital contributions of Carborundum-made wheels to America's defense.

Thousands of other products for defense and for normal needs are made by the rolling process. Plate glass for your car, steel rails, plastics, tin plate and paper are only a few. And since their surfaces can be only as perfect as the faces of the rolls that roll them, finish is highly important. Today, surface quality of rolls can be maintained to within a few millionths of an inch by the use of Carborundum-made grinding wheels.



The same skill and experience that have helped develop modern roll grinding technique will be at your disposal in any industry with which you may become associated. Whatever the use of grinding wheels or coated abrasives, Carborundum engineers are ready at all times to advise and help. The Carborundum Company, Niagara Falls, New York.

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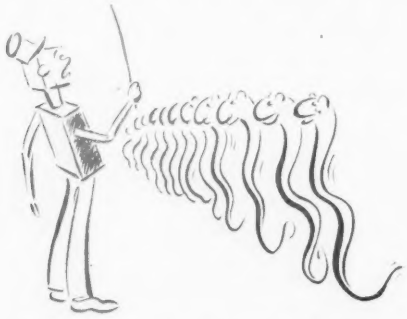
Carborundum and Aloxite are registered trade-marks of and indicate manufacture by The Carborundum Company.

G-E Campus News

BLACKOUT WATCHMAN

THE problem of maintaining a night light in his place of business and at the same time complying with blackout regulations was solved by a Schenectady machine-shop owner by means of a G-E photo tube, or "electric eye." Rules required that all lights be extinguished within five minutes of an air-raid warning. That meant either hiring a watchman or turning out all lights at closing time.

The first night that the lights were turned out, the shop was broken into. So the owner, Andrew Tessier, put the "electric eye" to work. He installed the tube in an upstairs window, pointing at the nearest street light. When, during a practice blackout or raid warning, the street light is extinguished, the tube immediately turns out all lights in the shop. When the street lights go on again, so do the night lights. The "eye" provides a watchman who doesn't go to sleep on his job, and whose total cost is about two weeks' pay for an actual watchman.



MOLECULES MARCH!

WITH the increasing use of plastics and of artificial silk and rubber in defense activities, the structural qualities of the molecules that make up these materials is all-important to the scientists who are doing the research work.

Dr. Raymond M. Fuoss, of the General Electric Research Laboratory, in Schenectady, has found that some molecules wiggle like worms when an alternating electric field is applied to them. Such molecules are electrically lopsided, and when in an electric field they tend to line up, just as compass needles line up with the magnetic field of the earth.

From this tendency of the molecules to move to and fro in an electric field, scientists are able to determine how the various molecules are built. With this information, new molecules can be designed to meet specific needs. Since artificial silk and rubber and many plastics are composed of these worm-like molecules which react in an electrical field, materials of a wide variety of properties may be expected as a result of these researches.

NOT FOR WILLIE—

THE General Electric Company is proud of the variety of services it renders its customers. Nevertheless, company officials were surprised by one recent request from a woman who had seen a G-E advertisement in a magazine.

The illustration in the advertisement contained a picture of a young boy. The woman also had a boy, and her boy looked very much like the boy in the photograph.

Mother and son had only recently moved to New York. Since then, she had taken her son to a number of different barbers, but none of them had produced a haircut that suited her. And so, in desperation, she wrote to General Electric to find where the boy in the advertisement had his hair cut. It was just the type of cut she had vainly tried to get.

GENERAL ELECTRIC

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